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(54) Ventilated disc brake

(57) Disc 1 has restricting means 10 by which flow of air over cooling vanes 4 of the disc 1 can be restricted and control means by which the restricting means is rendered operative to restrict such flow when cooling of the disc by air flowing over the cooling vanes is not required, the control means being such that in the event of failure of the control means they automatically set the restricting means to their non-restricting condition.

As shown, the restricting means is in the form of slides 10 which can be slid across to close exits 9 of passages between adjacent vanes 4 by actuators 11 controlled by the control means, which control means may be responsive to thermo couples 12 measuring temperature of exiting air or pyrometer 13 or rubbing temperature sensitive contact 14 or bimetallic member 15.

In Figure 2 inlet 8 on one side/both sides of the disc are restrictable by throttling elements (20).

The control means may also be responsive to other determinants possibly in combination e.g. time cycle, detection of failure of dynamic brake system.

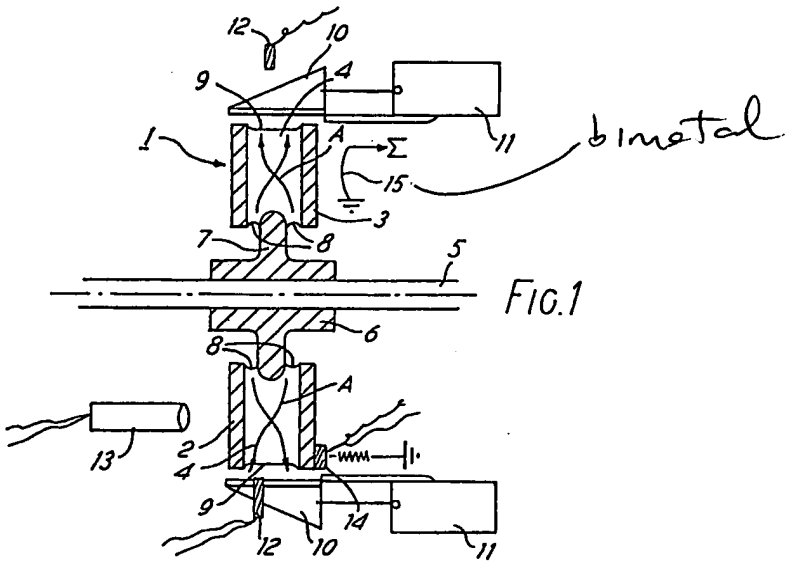

FIG.1

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The drawing(s) originally filed was (were) informal and the print here reproduced is taken from a later filed formal copy.

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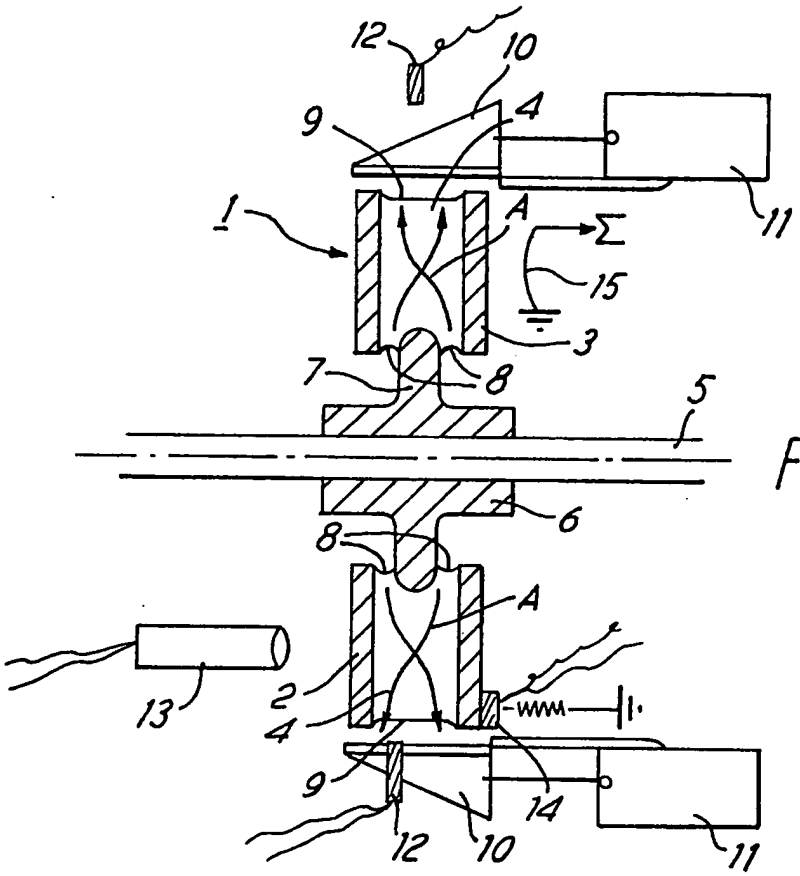

FIG.1

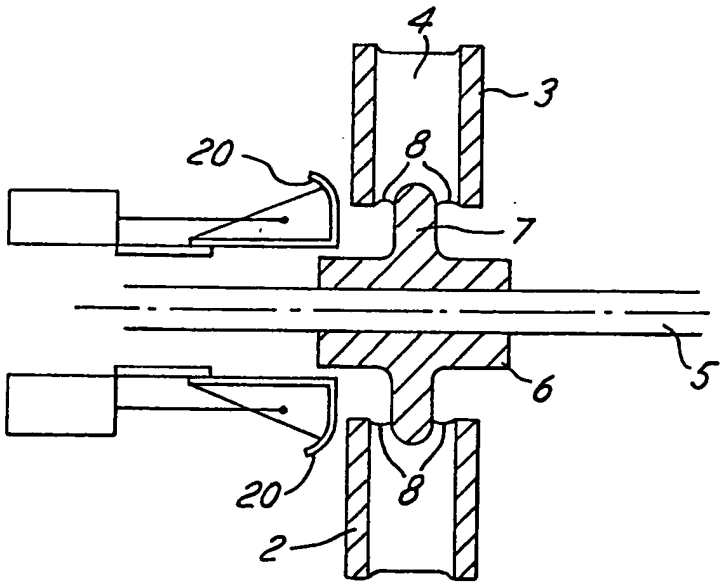

FIG.2

SPECIFICATION

Ventilated disc brake

This invention relates to disc brakes and, more particularly, to such brakes of which the disc incorporates ventilating cooling vanes.

Ventilated disc brakes are, of themselves, well known. However, in spite of their substantial advantages arising from their improved heat dissipation as compared to conventional non-ventilated disc brakes, they suffer certain disadvantages. In particular, the incorporation of the vanes consumes an appreciable amount of energy and generates considerable noise.

The advantages of the ventilated disc brake pertain only when heat dissipation is required whilst the disadvantages pertain for the whole of the time that the disc is in rotation whether being braked or otherwise.

Recognising these facts, the present invention provides a ventilated disc brake which, on the one hand, secures the benefits of a ventilated disc brake whilst, on the other hand minimising its disadvantages.

Accordingly, by the present invention, there is provided a ventilated disc brake having restricting means by which clow of air over the cooling vanes of the disc can be restricted and controlling means by which the restricting means is rendered operative to restrict such flow when cooling of the disc by air flowing over the cooling vanes is not required, the controlling means being such that in the event of failure of the controlling means they automatically set the restricting means to their non-restricting condition.

The restricting means may include a throttling device interposable across the entry to the path of flow of air over the cooling vanes. Conversely, the throttling device may be interposable across the exit to the path of flow of air over the cooling vanes.

The controlling means may be responsive to any one or any combination of the following determinants:-

the exit temperature of the air flowing over the cooling vanes

the temperature of the disc whether detected by contact with the disc or by the heat radiated from the disc

a time cycle based on the duty cycle of the brake the operation of the brake

the detection of failure of a dynamic brake system when such is provided on a vehicle fitted with the ventilated disc brake.

Embodiment of the present invention will now be described in greater detail, by way of example only with reference to the accompanying drawings of which:

Figure 1 shows, diagrammatically, a first ventilated disc brake, and

Figure 2 shows, diagrammatically, a second ventilated disc brake.

Referring to Figure 1, the disc 1 of the ventilated disc brake is of conventional construction in that it comprises a pair of disc-plates 2 and 3 between which are incorporated as a single casting vanes 4 which extend generally radially of the disc 1. The disc 1 is secured to a shaft 5 to be braked by the disc brake via a boss 6 secured to the shaft 5 and an integral web 7. For the purpose of clarity, the conventional brake pads are omitted.

Thus far described, the ventilated disc 1 is of well-known construction and the manner of operation of the brake pads to effect braking of the disc 1 will also be well-known to those skilled in the art thus not necessitating any further description here. Again as is well-known, the disc 1 is cooled by the configuration of the vanes 4 causing air to be drawn in at the entrance 8 on each side of the web 7 into the passages between adjacent vanes 4 to flow over the cooling vanes 4 in the direction of arrows A and exit at the exit 9 at the outer circumference of the disc 1.

As has been observed, this conventional construction incurs an undesirable loss of energy (which can well be of a significant value) in forcing the air across the cooling vanes 4 unnecessarily when the brake is not being operated. Also the passage of the air at the high speeds of rotation of the disc 1 generates unnecessary noise which can be to an objectionable level.

To minimise these disadvantages and in accordance with the present invention, there are provided restricting means in the form of slides 10 which can be slid across thus to close the exits 9 by actuators 11. The operation of the actuators 11 is controlled by control means (not shown as being of any one of a number of obvious alternatives) which are effective to operate the actuators 11 and thus close the exist 9 with the slides 10. The control means are responsive to thermocouples 12 which measure the temperature of the air exiting from the path of arrows A and, when this temperature is sensed by the thermocouples 12 as being below some predetermined value, the control means operates the actuators 11 to close the exit 9 and thus restrict flow of air in the path of arrows A. If the brakes are now applied this will cause heating of the disc 1 with consequent rise in temperature of the throttled exit air. When this rise in temperature is detected by the thermocouple 12, the control means will be activated to operate the actuators 10 and withdraw the slides 10 to allow cooling air freely to pass over the vanes 4.

The control means and actuators 11 are such that, in the event of any failure of the thermocouples 12 or the control means, the actuators 11 operate to withdraw the slides 12 from across the exit 9 thus providing "fail-to-safety".

As shown in Figure 1, the thermocouples 12 may be positioned clear of the slide 10 (as in the case of the upper thermocouple 12) or positioned so as to protrude through a slot in the slide 10 (as in the case of the lower thermocouple 12).

Alternative to the thermocouples 12 detecting the exit temperature of the air, the temperature of the disc may be sensed. This may be achieved by, for example, a pyrometer 13, a rubbing temperature-sensitive contact 14 or a bimetallic member 15 sensitive to the radiant temperature of the disc 1.

In Figure 2 in which like references indicate like parts to those in Figure 1, it is the inlet 8 on one side

of the disc 1 which is restricted by a throttling element 26 under the control of the actuators 11. Although the elements 20 are shown in Figure 2 as being on one side only of the disc 1, there may be such elements 20 on both sides of maximum restriction of the inlets 8 is required.

CLAIMS

1. A ventilated disc brake having restricting means by which flow of air over the cooling vanes of the disc can be restricted and controlling means by which the restricting means is rendered operative to restrict such flow when cooling of the disc by air flowing over the cooling vanes is not required, the controlling means being such that in the event of failure of the controlling means they automatically set the restricting means to their non-restricting condition.

2. A brake as claimed in Claim 1, wherein the restricting means includes a microcomputer the input(s) of which is a signal or are signals indicative of any one or any combination of the determinants.

3. A brake as claimed in Claim 1, wherein the restricting means includes a throttling device interposable across the exit to the path of flow of air over the cooling vanes.

4. A brake as claimed in any-one of the preceding Claims, wherein the control means responsive to any one or any combination of the following determinants:-

the exit temperature of the air flowing over the cooling vanes

the temperature of the disc whether detected by contact with the disc or by the heat radiated from the disc

a time cycle based on the duty cycle of the brake

the detection of failure of a dynamic brake system when such is provided on a vehicle fitted with the ventilated disc brake.

5. A ventilated disc brake substantially as herein described with reference to and as illustrated in either Figure 1 or Figure 2 of the accompanying drawings.

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ABSTRACT:

Disc 1 has restricting means 10 by which flow of air over cooling vanes 4 of the disc 1 can be restricted and control means by which the restricting means is rendered operative to restrict such flow when cooling of the disc by air flowing over the cooling vanes is not required, the control means being such that in the event of failure of the control means they automatically set the restricting means to their non-restricting condition.

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<IMAGE>